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SUPPLEMENTATION TO THE ENCYCLOPEDIA

Percutaneous Endoscopic Gastrostomy (pull method) and Jejunal Extension Tube Placement ☆

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Percutaneous endoscopic gastrostomy;
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Video

Abstract
Background: Enteral feeding should be considered for patients with an intact and functional gastrointestinal tract. Percutaneous endoscopic gastrostomy (PEG) tube placement is indicated in patients requiring medium to long term enteral feeding (>30 days) and with impaired swallowing.
Patients and methods: In this video manuscript, we demonstrate the complete PEG procedure (pull method) in a 65 year old patient and placement of PEG jejunal extension tube in another patient who needed post-pyloric enteral feeding.
Conclusions: PEG-pull method is the most widely used PEG technique. Appropriate patient selection, timing of the procedure, informed consent, antibiotic prophylaxis, adequate endoscopic air insufflation during PEG site selection, and optimal PEG site localization are the keys in this procedure.

Video related to this article

Video related to this article can be found online at http://dx.doi.org/10.1016/j.vjgien.2013.10.004.

1. Background

- A 65 year old man was referred for percutaneous endoscopic gastrostomy (PEG) for enteral feeding.
- After dysphagic stroke, the patient developed impaired swallowing without improvement and failed a 3 weeks trial of nasogastric feeding.
- The patient and his family consented with PEG.
- Abdominal examination revealed no shifting dullness or surgical scars in the upper abdomen.

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- On laboratory studies, there was no coagulopathy and leucocytosis.
- A dose of parenteral antibiotics is given 30 min before the procedure for prophylaxis.

2. Materials

- Diagnostic gastroscope (Olympus GIF-Q180, Olympus America, Center Valley, PA),
- percutaneous endoscopic gastrostomy set (PEG-24-PULL-S, Cook Medical, Winston-Salem, NC),
- PEG-jejunal tube extension tube (FLOWJ-9-20-S, PEGJ-12-24-S, Cook Medical), and
- endoclips (Instinct® clip, Cook Medical).

3. PEG (pull-through technique or pull method)

- The patient is placed in a supine position and the wrist restraints can be used during the procedure in selected patients.
- Diagnostic esophagogastroduodenoscopy is performed under standard sedation.
- A PEG set and a pair of sterile surgical gloves is placed on a bedside tray.
- The gastrostomy site is carefully selected and marked based on the followings:
  - Applying adequate endoscopic air insufflation to bring the gastric wall in apposition with the abdominal wall and no tissue or other organ lay between.
  - The optimal site is usually in the left upper quadrant about 2–4 cm below the costal margin or occasionally in the epigastric area.
  - Obtaining optimal trans-abdominal light illumination (Figure 1) and external finger or digital indentation.
    - The room lights are dimmed and the tip of the endoscope is directed to face the anterior abdominal wall.
    - The ideal site is selected and marked after endoscopically confirmed digital indentation at the location of maximum light trans-illumination.
    - If no optimal light trans-illumination is present during the procedure but good external finger indentation can be obtained, trans-abdominal wall needle insertion can be attempted.
- The skin at the marked site is prepped with topical antiseptic in a sterile fashion.
- The assistant opens the sealed cover of the PEG set, puts on the sterile gloves, and passes the enclosed endoscopic snare and PEG tube to the endoscopic staff.
- The region around the marked site is dressed with sterile drape(s).
- The selected site again confirmed by applying digital indentation on the gastric wall.
- Administer local anesthesia (10 mL 1% xylocaine) using a 25-gauge needle and advance the needle vertically into the stomach under endoscopic guidance.
  - During deep needle advancement and needle withdraw outside the gastric lumen, apply negative pressure on the syringe plunger to ensure no air, stool, or blood return into the syringe.
  - Air or stool aspiration may indicate puncture of an adjacent organ (colon or small bowel).
  - Administer 1% xylocaine during needle withdraw at 0.5–1 mL aliquot within the needle path after each intermittent negative pressure test.
- About 1 cm skin incision is made at the marked site with a surgical scalpel.
- A large-bore (13.5-gauge) needle with cover sheath (cannula) is advanced following the prior needle path into the stomach, guided by endoscopy (Figure 2).
  - The needle is removed.
  - The PEG wire is brought through the cannula into the stomach and grasped by the endoscopic snare.
- The endoscope with secured wire is withdrawn through the mouth.

Figure 1 Image showing optimal trans-abdominal light illumination.

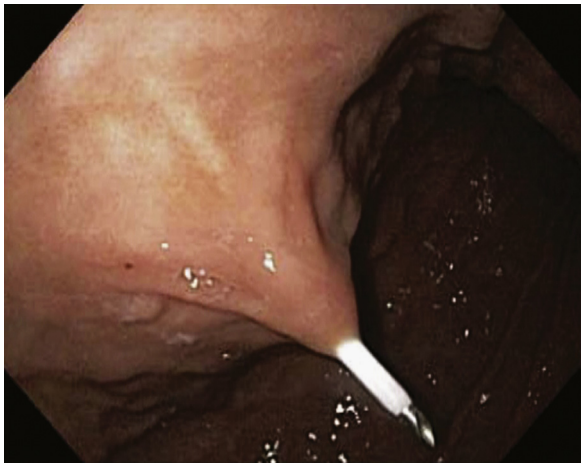

Figure 2 Endoscopic image showing the needle with a plastic sheath (cannula) punctured through the abdominal and gastric walls into the stomach.

- The oral end of the wire is usually looped. The wire tip is first passed through the open loop at the tip of the feeding tube. The wire loop is then opened and the internal bumper of the PEG tube is passed through. Now the wire and the PEG tube are firmly knotted.
- The external surface of the internal bumper and external tubing are lubricated.
- Insertion of the feeding tube (usually 20 or 24 French) using the standard *p*ull-through technique.
  - Slowly and firmly pull the wire from the abdominal side, bring the introducer and PEG tube from the mouth through the stomach and abdominal wall to the outside leaving the internal bumper inside the stomach against the gastric mucosa.
  - More firm pulling force is needed when the dilating part or introducer of the PEG tube is passing through the abdominal wall.
  - Occasionally, additional deeper skin incision is needed to cut the hypodermis in order to pull the PEG tube through the abdominal wall.
- An external bumper or bolster is applied over the PEG tubing next to the skin.
  - Adequate tension is applied on the external bumper next to the skin minimizing the risk of bleeding.
  - Avoid excessive tension to minimize the risk of buried bumper syndrome development.
  - Document the position of the external bumper on the PEG tubing in terms of centimeter (usually <4 cm) in the endoscopy report. This is the "track length".
- The PEG tube is cut from the introducer and trimmed to appropriate length about 20 cm. On this particular PEG tube (PEG-24-PULL-S, Cook Medical), the site is pre-marked with a "$\times$".
- The C-clamp is applied over the PEG tube.
- The Y-adapter is placed to the end of PEG tube: one opening for tube feeding and another one for water flushing.
- Antibiotic cream is applied around the PEG stoma and the site is covered with gauze and tape. An optional abdominal binder can be placed.
- Optional post-procedure endoscopy can be performed at the discretion of the endoscopist to document the internal bumper's location (Figure 3) and to rule out accidental esophageal injury during PEG pull-through.
- Enteral feeding through the PEG tube (Figure 4) can be started 4 h after the procedure [1].

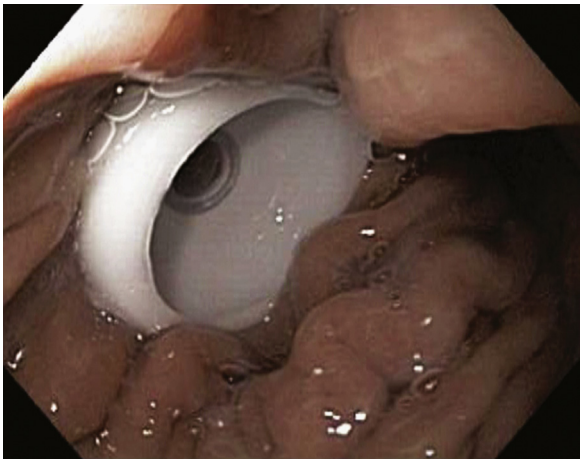

Figure 3 Endoscopic image showing a newly placed PEG with its internal bumper.

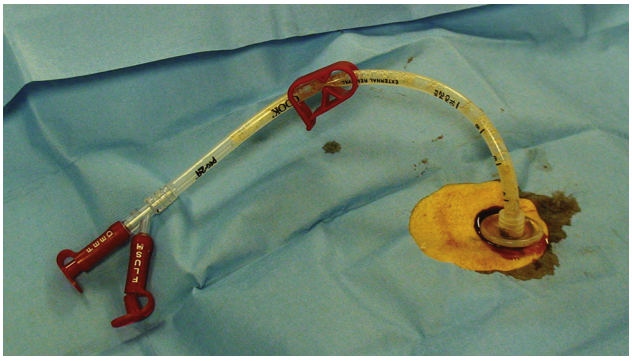

Figure 4 Image of a placed percutaneous endoscopic gastrostomy tube with an external bumper or bolster next to the skin, a C-clamp on the tube, and a Y-adapter for tube feeding and flushing.

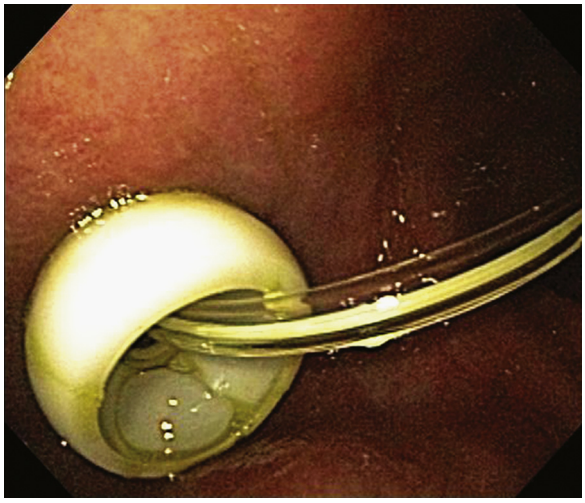

Figure 5 Endoscopic image showing a PEG jejunal extension tube placed through PEG.

4. Jejunal extension tube placement through PEG

- In selected patients with an indication for post-pyloric enteral feeding, the PEG tube can be converted to PEG-jejunal (PEGJ) tube for jejunal feeding [3].
  - A jejunal extension tube (9 or 12 French) is inserted through a large diameter PEG tube (Figure 5) (a 20 French PEG for a 9 French jejunal tube and a 24 French PEG for a 12 French jejunal tube).
  - The inserted jejunal extension tube can be grasped endoscopically and dragged into the small bowel.
  - Endoclips can be applied to anchor the jejunal tube in the small bowel minimizing the risk of proximal migration (Figure 6). Currently, no endoscopic technique including endoclip application has shown to prevent tube proximal migration.

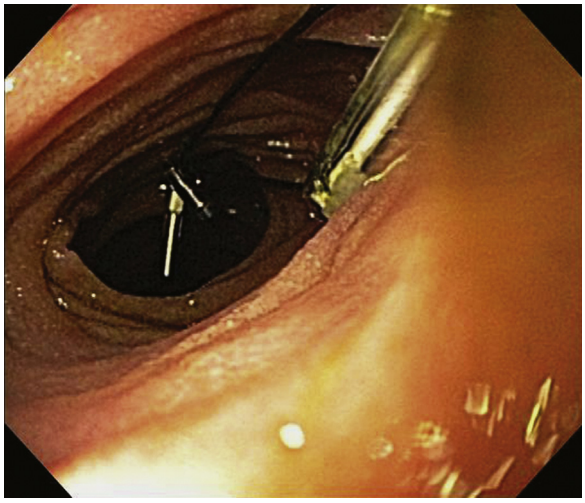

Figure 6 Endoscopic image showing a PEG jejunal extension tube is anchored in the small bowel with two endoclips and a pre-placed surgical surgical suture on the tip of the tube.

5. Key learning points and tips and tricks

- Enteral feeding should be considered for patients with an intact and functional gastrointestinal tract [1-3].
- Nasoenteral feeding is preferred for patients who are expect to resume oral nutrition within 30 days [1-3].
- Indications for PEG [1-5].
  - Requiring medium to long term enteral feeding (>30 days).
  - Impaired swallowing.
    - Dysphagia stroke and other neurological diseases.
    - Neoplasms of the oropharynx, larynx, and esophagus [5].
    - Head and facial trauma.
  - Gastric decompression (venting gastrostomy)
    - Malignant bowel obstruction
    - Gastroparesis
  - Gastroplexy [6].

- Contraindications [1-5].
  - Absolute contraindications:
    - Pharyngeal or esophageal obstruction.
    - Significant coagulopathy.
    - Inability to approximate the gastric wall to the abdominal wall.
    - Suspected adjacent organs involvement.
  - Relative contraindications:
    - Ascites
    - Large gastric varices
    - Morbid obesity
    - Extensive abdominal surgery
    - Inflammatory or infiltrative process of the abdominal wall
- Antimicrobial prophylaxis decreases the risk of peri-stomal infection and is cost-effective [1].
- Two most common PEG techniques are the pull (or pull-through) method and push (or introducer) method [7-9].
  - Pull method
    - The most widely used method and it was first described by Gauderer and Ponsky in 1980 [7,8].
    - There is a real but very small risk of tumor seeding at the PEG site in patients with laryngeal and esophageal cancers [10-12].
  - Push method
    - Feasible in patients with pharyngeal or esophageal obstruction.
    - When performed under fluoroscopy, can avoid bowel injury.
- In a retrospective analysis comparing the complication rates between the PEG pull through and introducer techniques, there were more short term complications with introducer PEG placement: 46% versus 12.1% compared with 4/33 patients (12.1%) [9]. The rates of local infections, bleeding, and perforation were not statistically different between the insertion techniques. The mortality rate tended to be higher following the introducer technique than after the pull-through technique.
- Immediately after PEG procedure, pneumoperitoneum is not uncommon on imaging studies. This is not clinically significant unless there are symptoms and signs of peritonitis [1,3].
- The success rate of PEG ranges from 76% to 100% [3].
  - Reasons for failure include
    - Inadequate trans-abdominal wall light illumination.
    - Complete oropharyngeal or esophageal obstruction.
    - Gastric resection.
- PEG tract usually matures over several weeks.

- Appropriate post-PEG stomal education and care should be provided to the patient and the care providers [13].
- PEG removal can be achieved with one of these options [1]:
  - Gentle manual traction of the external tubing and removal of the PEG tube with its internal bumper (collapsible version) through the matured PEG stoma. This is performed without sedation.
  - Endoscopic removal of the internal bumper after cutting the feeding tube close to the skin.
  - Cutting the tubing close to the skin and pushing the internal bumper into the stomach.
    - Spontaneous passage of the internal bumper through the GI tract
    - Small risk (2-3%) of bowel obstruction by the migrating bumper

6. Complications and risk factors

- Hemorrhage (local stoma bleeding, hematoma, gastrointestinal bleeding)
- Injury to the adjacent organs (liver, colon, small bowel)
- Perforation
- Infections (peri-stomal cellulitis, peritonitis, abdominal abscess, necrotizing fasciitis)

- Esophageal injury
- Buried bumper syndrome
- Aspiration

Scripted voiceover

Voiceover Text

The patient is placed in a supine position and the wrist restraints are commonly used during the procedure.
A dose of parental antibiotics is given 30 minutes before the procedure for prophylaxis.
A PEG set and a pair of sterile surgical gloves is placed on a bedside tray.
The gastrostomy site is carefully selected and marked based on the followings maneuvers.
First, apply adequate endoscopic air insufflation to bring the gastric wall in apposition with the abdominal wall and to minimize the risk of having tissue or other organ lay between.
The optimal site is usually in the left upper quadrant about 2-4cm below the costal margin or occasionally in the epigastric area.
Obtain optimal trans-abdominal light illumination and external finger or digital indentation. The room lights are dimmed and the tip of the endoscope is directed to face the anterior abdominal wall.
The ideal site is selected and marked after endoscopically confirmed digital indentation at the location of maximum light trans-illumination.
The skin at the marked site is prepped with topical antiseptic in a sterile fashion.
The assistant opens the sealed cover of the PEG set and puts on the sterile gloves.
The assistant then passes the enclosed endoscopic snare and PEG tube to the endoscopic staff.
The region around the marked site is dressed with a sterile drape.
The assistant is preparing for local anesthesia injection with a 10mL 1% xylocaine and a 25-gauge needle.
The selected site is again confirmed by applying digital indentation on the gastric wall.
Advance the needle vertically into the stomach under endoscopic guidance. During deep needle advancement and needle withdraw outside the gastric lumen; apply negative pressure on the syringe plunger to ensure no air, stool, or blood return into the syringe.
Air or stool aspiration may indicate puncture of an adjacent organ such as colon or small bowel.
Administer 1% xylocaine during needle withdraw at 0.5-1 mL aliquot within the needle path after each intermittent negative pressure test.
About 1 cm skin incision is made at the marked site with a surgical scalpel.
A large-bore (13.5-gauge) needle with cover sheath (cannula) is advanced following the prior needle path into the stomach, guided by endoscopy.
The needle is then removed.
The PEG wire is brought through the cannula into the stomach and grasped by the endoscopic snare.
The endoscope with secured wire is withdrawn through the mouth.
The oral end of the wire is usually looped. The wire tip is first passed through the open loop at the tip of the feeding tube. The wire loop is then opened and the internal bumper of the PEG tube is passed through.
Now the wire and the PEG tube are firmly knotted.
The external surface of the internal bumper and external tubing are lubricated.
We are inserting the feeding tube (usually 20 or 24 French) using the standard pull-through technique.
Slowly and firmly, the assistant is pulling the wire from the abdominal side, bringing the introducer and PEG tube from the mouth through the stomach.
Occasionally, additional deeper skin incision is needed to cut the hypodermis in order to pull the PEG tube through the abdominal wall.
Antibiotic cream is applied around the PEG stoma.
The external bumper or bolster is applied over the PEG tube next to the skin.
Adequate tension is applied on the external bumper to minimize the risk of bleeding and leakage.
On the other hand, excessive tension should be avoided to minimize the risk of buried bumper syndrome development.
The C-clamp is applied over the PEG tube. The PEG tube is cut from the introducer and trimmed to appropriate length about 20 cm.
The Y-adaptor is placed to the end of PEG tube: one opening for tube feeding and another one for water flushing. Document the position of the external bumper on the PEG tubing in terms of centimeter in the endoscopy report.
In selected patients with an indication for post-pyloric enteral feeding, the PEG tube can be converted to PEG-jejunal tube for jejunal feeding.
A jejunal extension tube (9 or 12 French) is inserted through a large diameter PEG tube. The inserted jejunal extension tube can be grasped endoscopically and dragged into the small bowel.
Endoclips can be applied to anchor the jejunal tube in the small bowel minimizing the risk of proximal migration.
Percutaneous endoscopic gastrostomy (PEG) tube placement is indicated in patients requiring medium to long term enteral feeding and with impaired swallowing.
PEG-pull method is the most widely used PEG technique. Appropriate patient selection, timing of the procedure, informed consent, antibiotic prophylaxis, adequate endoscopic air insufflation during PEG site selection, and optimal PEG site localization are the keys in this procedure.

Conflict of interest

None.

Funding source

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